

## *Retraction*

# **Retracted: Consumption Reduction Solution of TV News Broadcast System Based on Wireless Communication Network**

### **Complexity**

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

- (1) Discrepancies in scope
- (2) Discrepancies in the description of the research reported
- (3) Discrepancies between the availability of data and the research described
- (4) Inappropriate citations
- (5) Incoherent, meaningless and/or irrelevant content included in the article
- (6) Manipulated or compromised peer review

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

### **References**

- [1] H. Qiang, "Consumption Reduction Solution of TV News Broadcast System Based on Wireless Communication Network," *Complexity*, vol. 2021, Article ID 9936803, 13 pages, 2021.

## Research Article

# Consumption Reduction Solution of TV News Broadcast System Based on Wireless Communication Network

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At present, the news broadcast system using mobile network on the market provides the basic functions required by TV stations, but there are still many problems and shortcomings. In view of the main problems existing in the current system and combined with the actual needs of current users, this paper has preliminarily developed a news broadcast system based on 5G Live. The card frame adaptive strategy significantly improves the user experience by using gradual video frame buffering technology. Hardware codec technology significantly reduces the consumption of system resources; H.264 high-compression algorithm can reduce network bandwidth by 50% compared with MPEG-2 and MPEG-4 without a significant change in image quality. At the same time, the use of mobile video acquisition terminals in the system not only solves the problem that satellite broadcast vehicles cannot reach the site due to the lack of roads but also greatly reduces the cost of early deployment and late maintenance of the news broadcast system. This paper studies the card frame adaptive strategy, the system resource consumption reduction solution, and the deployment scheme of the mobile video and audio transmission terminal, which is of great significance to improve the design and research of the news broadcast system under the wireless network application and also has certain reference value for the design of other broadcasting and television solutions.

## 1. Introduction

With the continuous development of technology, high-definition TV programs have become an indispensable part of people's lives. At the same time, more and more TV stations are adding high-definition channels to meet people's growing demand for pictures. But the clarity of live shows is far from what audiences want. Radio and TV transmission technology is mainly microwave, optical fiber, satellite, and so on. The application of satellite transmission needs to be applied in advance and the cost is high [1]. The microwave transmission distance is limited, and there is no barrier between the transmitting end and the receiving end. At the same time, microwave transmission is vulnerable to weather and electromagnetic interference, so the traditional method still has some shortcomings in transmitting HD live programs. At the same time, there are still many problems with the existing technologies in 5G transmission, 4 K ultra-high-definition codec, integrated production (IP), and convenient

use of adapted news production and broadcast [2]. Therefore, it is very necessary to optimize the TV news broadcast system based on wireless communication network.

In view of the limitations of traditional broadcasting and television transmission of UHD live TV programs, this paper proposes a design scheme of UHD live TV programs transmission using 5G network. The system uses card frame adaptive strategy, the system resource consumption solutions, and H.264 key technology such as high-compression algorithm, and according to the theory of software engineering method, the card frame adaptive strategy, the system resource consumption solutions, and H.264 high-compression technology are applied to actual projects; they basically solved the main problems of current news broadcast system. Through the application of the above technologies, the project in this paper has realized the live video collection from the scene to the live video presentation in the news broadcast room, which has reached the user's expectation and basically realized the expected demand. At

the same time, the system does not need any expensive transmission vehicles, satellite links, or professional on-site technical personnel support; it only needs on-site reporters and camera personnel to complete the remote broadcast effect, so the program production cost of the TV station is greatly reduced, and the cost of personnel input is reduced. In addition, due to the ease of use and convenience of the 5G broadcast transmission system, it can fully meet the requirements of TV stations to present important news to the audience anytime and anywhere, greatly improving the timeliness of news.

The rest of this paper is organized as follows: the related work is discussed in Section 2. Section 3 expounds the 5G Live news broadcast system. Section 4 designs and analyzes the further optimization scheme of the system. System performance test is shown in Section 5, and Section 6 summarizes the whole paper.

## 2. Related Work

Network transmission environment and transmission quality directly determine the success or failure of new media mobile live streaming and the quality of terminal live streaming picture. At present, front-end shooting, streaming, and transmission devices commonly used in new media mobile live broadcasting are mainly composed of mobile phones combined with professional live broadcasting APPs, cameras combined with wireless backpacks, or other streaming transmission devices [3, 4]. It integrates wireless transmission technology, video and audio codec technology, and digital encryption and decryption technology and utilizes wireless high-speed mobile network to realize high-definition processing and smooth transmission of digital images and sounds through multiple wireless links. Wireless network is a huge network built by mobile operators covering the whole society. It uses the existing wireless network built by operators to transmit mobile video images and sounds. It has the advantages of nonlinearity, mobility, portability, high bandwidth, high clarity, bidirectionality, and so on. As long as the mobile phone wireless signal can cover the geographical location, it can transmit video and audio and solve the live broadcast scene being located outdoors, shooting a large range, strong mobility, and other problems of inconvenient deployment of dedicated transmission network. Compared with satellite and other transmission methods, using wireless backpack to realize live streaming transmission has great advantages in transmission cost. In recent years, wireless backpack transmission scheme has been widely used in new media mobile live broadcast.

Reviewing the previous mobile live broadcast of new media, network transmission means mainly include wired broadband with wireless WIFI transmission, wireless network transmission, and hybrid transmission. In CCTV5, CCTV5+, CCTV2, CCTV4, and variety channel about 41 new media mobile live broadcast, the use of wireless backpack as a transmission means has accounted for 53% [5]. Most live broadcast sites are outdoors, such as stadiums, venues, open-air venues, and some indoor areas that do not have the conditions of wired network deployment [6]. Most

of the business processes are multiposition shooting in the front field. Mobile phones or cameras cooperate with wireless backpack to send back live stream, receive in the back field, and push live stream to the release platform after switching and packaging processing.

As for the concept of TV news live broadcast, experts and scholars who study TV news have different but similar definitions. Lau et. al [7] believe that the so-called TV news live broadcast is in the scene of the news facts, news images, sound and the front-line reporter's reports, interviews, and so on into the network electrical signal transmission back to the immediate broadcast way. Walker et al. [8] pointed out that with the spread of modern electronic technology, TV news broadcasts carry real-time information through news studios or news websites and simultaneously convey opinions and emotional information to the audience. The latter definition clearly defines the personality of live news broadcast, highlighting the means of communication, the content of communication, and the symbols of communication. The five links of TV news live shooting, processing, synthesis, broadcast, and audience reception are synchronous and direct, and there is no corresponding time difference.

In view of the limitations of traditional broadcast and television transmission of 4K UHD live TV programs, Jingwen et al. [9] proposed a design scheme for transmitting 4K UHD live TV programs by using mature 4G network, which is easy to use and convenient. At the same time, this scheme provides a design idea for the next broadcast TV 5G+4K AI. Dai et al. [10] proposed 4G-based transmission technologies such as high-definition TV transmission system with 4G technology as the means of traditional high-definition television transmitted, allowing users to broadcast HD TV anytime and anywhere for professional and amateur users to provide good cost performance and flexibility of HD video transmission method; the system adopts the adaptive and card binding, load balancing, and key technology such as smart antenna, making the performance of the system greatly improved. The 4G-based mobile video streaming media acquisition and editing system proposed by Issa et al. [11] uses mobile streaming media service, refers to the PSS technical specification, is based on MPEG-4 standard and RTP/RTCP protocol, and has high compression rate, low-complexity video coding, and high-reliability transmission. With the further development of wireless communication network technology, after the commercialization of 4G, 5G [12], or higher bandwidth and faster wireless communication technology, we should explore the transmission mode that can better reflect the timeliness of news and make the "normalization of live broadcast" become a reality within reach.

## 3. G Live News Streaming System

*3.1. Overall Architecture.* The overall framework of the system designed in this paper is shown in Figure 1, which is mainly composed of three core parts, namely, the sending end, the server, and the receiving end.

The main work of the sending end is to transmit the collected audio and video to the server through various audio and video acquisition equipment (US, gun type, spherical camera, microphone, etc.) through H.264 and AAC compression coding. After receiving the data, the server encapsulates the RTP packet and sends it to the network for transmission [12]. The server of the system designed in this paper is based on DSS infrastructure. Aiming at the problem of network congestion and packet loss caused by UDP transmission in the live broadcast system, a congestion control scheme based on RTCP feedback is designed and implemented. The final result shows that the scheme used has a significant effect. The receiving end first analyzes the received RTP packets and recombines them and then sends them into the buffer to be decoded and played.

The overall core structure of the DSS server involved in this system is shown in Figure 2, which mainly contains three types of elements, namely, threads, Task queues or heats, and events to be listened on.

The Task class in the figure contains the Signal and Run methods. The Signal method [13] adds a Task to the Task queue of a Task thread, and the Run method is responsible for processing the Task. Based on the Task class, three types of Task are defined: initiation, dispatcher, and event handler. The DSS core mainly contains the following types of threads: event demultiplexer, concrete event handler, and reactor.

**3.2. Audio and Video Processing Process.** The core process of news broadcast system is the processing of video frame data, which is related to system delay and user perception. It focuses on using the original data buffer, instead of using different data flow rate and the format of the data buffer, and by means of differential rate of real-time monitoring picture code, which, to a certain extent, reduce the system resource utilization, so that the system using the hardware configuration has a certain degree of reduced, thereby saving the 3G live hardware upgrade costs from the news broadcast system upgrade.

The most important part of the processing of video and audio frames is the frequency data receiving of video frames. When receiving the video data of the network transmission module, the data is first parsed to verify the validity of the data, and the attribute parameters of the video frame are identified and put into the corresponding type variable, waiting for the next step of processing. The data received in the previous step are used to parse the video frame according to the parsed video frame parameters and the parsed video frame, and the corresponding video frame parameters are put into the corresponding structure or class variable. Push each video frame to the module that needs to use the frame, such as video coding module, video file recording module, SDI output module, etc., and record the usage times of each frame at the same time. When each frame block has reached the number of times it should be used, the frame memory is put into the queue waiting to be used. Optimizing transcoding can determine the proportion of system resource consumption of audio and video transcoding. By optimizing

the system resource occupation of transcoding (encoding and decoding), the consumption of system resources can be reduced to a certain extent.

**3.3. Scene Classification Algorithm.** The scene classification module is called by the Spark task and outputs the classification results based on the input data. It connects down to the MSAN classification model implemented on the Caffe platform and encapsulates the model invocation methods.

When video key frames are directly extracted as training data and inputted into the AlexNet model [14] for training, the accuracy rate of 87.9% can be achieved on the test set after parameter adjustment. After histogram equalization, the project data was input into the AlexNet model. The results show that the edge texture features obtained from the processed image data are clearer.

In this study, it was found that a complex landscape can be represented linearly by 64 orthogonal fundamental matrix structures, so the researchers used pooling to aggregate statistics on map to obtain relatively low-dimensional feature data. The convolution and pooling of CNN can be said to be the feature mapping of input data, while the full connection layer completes the statistical classification of the features extracted from the network [15]. The convolution layer is mainly used to complete the convolution operation to extract the data features. The essence of the convolution operation is to slide the convolution kernel size window from left to right to top down with a given step size on the convoluted matrix and to obtain the result of summation after multiplying the matrix in the window and the convolution check element. Convolution calculation is shown in Figure 3. Matrix  $9 \times 9$  is the convoluted matrix, and the convolution kernel Kernel  $3 \times 3$  is used to convolve it with a step size of 2 to obtain Result  $4 \times 4$  results.

In addition, the system uses Sigmoid function and Tan Hyperbolic (Tanh) function in neural network to simulate the brain neural model [16]. The Sigmoid and Tanh functions are shown in Figure 4, and the curves of both are similar. Both of them can simulate the activation state of the brain neural model to some extent, but they also have a large output when the input value approaches 0 in the negative direction. The parameters in the model are adjusted by Back Propagation (BP) algorithm in the whole network. For AlexNet, the convolution kernel and the size of bias in the network are calculated [17]. During network training, the network model will be initialized first, and the network parameters will be randomly assigned, and then the input data will be calculated with these parameters to get the actual output. The BP algorithm adjusts the model parameters in reverse based on the gradient descent (GD) strategy by the error between the actual output and the expected output.

**3.4. Data Storage Design.** The data of 5G Live recording/broadcasting server includes video and audio files, configuration files of the recording/broadcasting server, TV program lists, information tables of the corresponding multichannel media server, and SDI output registration tables.

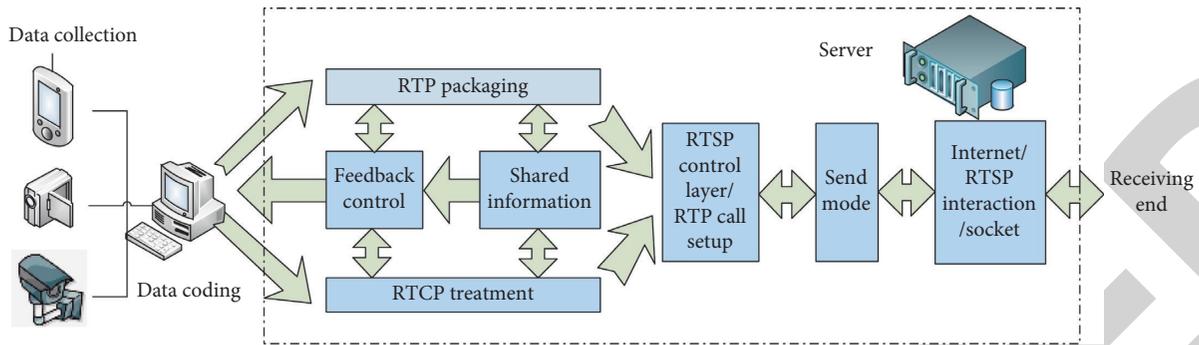


FIGURE 1: System basic framework.

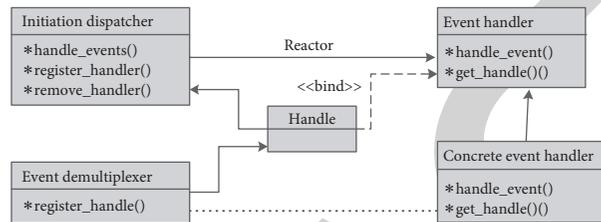


FIGURE 2: Server core architecture.

The most important data in the 5G Live record/broadcast server are audio and video files. In this kind of files, disk preallocation is adopted, which fully ensures the lack of disk space and the generation of disk fragmentation when data is saved. This is because the lack of disk space when data is saved is a very serious failure for the preservation of live video. Preallocated disk space can prevent this failure from occurring. Disk fragmentation will result in the breakdown of video and audio frames during high bitrate video playback and transmission, which will seriously affect the user experience.

The video and audio files are allocated according to the program type of the TV station and then classified according to the date in the folder. In order to facilitate users to find and download files, the project researchers also designed a suffix index file with the same name in the folder where the corresponding video and audio files are located. This design is used when the user downloads part of the video. When the user downloads part of the current video and audio file, by reading the index file, the position of the user's target time file in the main file can be obtained and the reading can be started directly. As is known to all, it takes a long waiting time to find a video at a time point in a video file. The way of downloading through index search greatly reduces the user's waiting time during operation and improves the user experience.

## 4. System Optimization Strategy

**4.1. Adaptive Strategy of Card Frame.** In this project, the adaptive strategy of card frame is divided into two steps: firstly, in the case of video and audio return frame, a progressive return frame is adopted, which reduces the number of cyclic repeats of return frame within a certain period of

time. The specific way is that among all repeated frames, the farther the frame is from the breaking point of the frame, the more the repetition times are, and the repetition times follow the principle of smooth gradient. If the network condition is still poor after the repetition, all existing video/audio frames are rendered as in the previous step. Users' subjective feelings largely come from the number of buffering frame cycles. The above method can reduce the number of buffering frame cycles to a large extent, thus enhancing users' feelings.

On the basis of the above method, the video and audio frames that need to be transmitted are transmitted in the way of dynamic bitrate. RTSP protocol plays the role of "network remote control" for streaming media service in establishing and controlling the time synchronization stream of continuous media. 3GPP's RTSP protocol header carries parameters that are used by the client to report to the server during session establishment about the parameters of the currently used wireless link. The sender can set the bitrate and link response according to these parameters.

The sender uses RTCP and RTSP as the basic source of information describing the current state of the network and the client [18]. As long as the client sends standard RTCP acceptance reports to the audio/video sender with sufficient frequency, this link-rate adaptation mechanism can be adopted in practical applications. RTCP accepts the data structure that reports RR, as shown in Figure 5, with red boxes indicating the information bits associated with packet loss and jitter: fraction lost and interarrival Jitter fields.

**4.2. System Resource Consumption Reduction Strategy.** In order to achieve high-definition video, top signal indicators, and high-precision processing, the project decided to use Redbridge II board cards for hard decoding of the project,

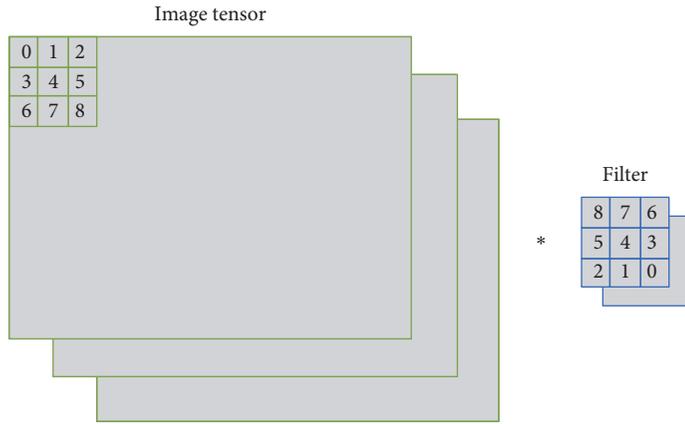


FIGURE 3: Process of convolution in CNN.

which further reduced the delay compared to most systems using soft decoding solutions, especially after the buffer frame is put into the board card. The video and audio interfaces of Redbridge II adopt the upper limit of national standard, 10 bits for SDI video and 24 bits for AES/EBU audio [19]. Redbridge II is also downward compatible with the other quantization steps described in the standard. It can be said that Redbridge II is designed for the top HD studios.

For the evaluation of HD.SDI interface characteristics, jitter is a very key index. Jitter size determines the signal in the system through the ability; too large jitter will lead to long-distance signal transmission error rate increase so that the picture degrades. In the national standard, the jitter of 100 KHz is less than 0.2 UI, and the jitter of 10 Hz is less than 1 UI. The two indexes of Redbridge II are 0.14 UI and 0.16 UI, respectively, five times higher than the current international standard, which reduces the bit error rate of Redbridge II to almost zero when transmitting signals. In addition, in terms of channel characteristics of HD.SDI, amplitude-frequency characteristics and nonlinear distortion represent the degree of attenuation and distortion after the signal passes through the system. The smaller the two indicators are, the better. Although there is no clear requirement for this in the national standard, the amplitude-frequency characteristics of Y/PB/PR channels of Redbridge II are all 0, and the nonlinear distortion is less than 0.1%, which is 5~10 times higher than the corresponding indexes of the current common international brands. The specific dithering picture degradation and nonlinear distortion schematic diagram are shown in Figure 6.

**4.3. Video Compression Technology.** H.264 is compressed by the video encoding VCLt2q and network abstraction layer NAL in two parts. The VCL includes the VCL encoder and the VCL decoder; the main function is to video data compression encoding and decoding. It includes motion compensation unit entropy coding, transform coding, etc. NAL for VCL provides a unified interface; it has nothing to do with the network of video data encapsulation packaging

$9 \times C$  FMAs/output: math intensive

$$\begin{aligned} &0 \times 8 + 1 \times 7 + 2 \times 6 + \\ &3 \times 5 + 4 \times 4 + 5 \times 3 + \\ &6 \times 2 + 7 \times 1 + 8 \times 0 + \end{aligned}$$

$9 \times K$  FMAs/Input: good data reuse

$$\begin{aligned} &4 \times 0 + 4 \times 1 + 4 \times 2 + \\ &4 \times 3 + 4 \times 4 + 4 \times 5 + \\ &4 \times 6 + 4 \times 7 + 4 \times 8 + \end{aligned}$$

to make it a unified data format in the network transmission [20–24].

The coding system block diagram of H.264 video coding layer is shown in Figure 7. The encoder adopts a hybrid encoding method of prediction and transformation. The main parts of the encoder include intraframe prediction, interframe prediction, transformation, quantization, deblocking filtering, and entropy coding.

In order to demonstrate the excellent coding performance of H.264, we compare it with the previous video coding standards MPEG-2, H.263, and MPEG-4 and use Tempete, which is a representative test sequence, to verify it. RD curves generated by four standard codes are shown in Figure 8. It can be seen that at the same bitrate, the peak signal-to-noise ratio (PSNR) of H.264 can be increased by 4.5 dB compared with MPEG. 2 and 2.3 dB compared with H. 263 and MPEG-4. With the same degree of image distortion, H.264 achieves a 60 percent reduction in bitrate compared to MPEG—2.70%, 40% more than H.263 and MPEG—4.50% bitrate savings. In these four coding standards, H.264 compression performance is relatively high.

Flexible Macro Block Arranging (FMO) is a unique error-resistant coding technology in H. 264's basic and extensible grades [25]. FMO allocates mapping technology in the unit of macro blocks. Each macro block is allocated to each slice without scanning order, and multiple slices are formed into a slice group. In the prediction mechanism inside the image, only adjacent macro blocks in the same slice group are allowed to limit the error code in one slice to prevent its diffusion, and the macro blocks around the correctly decoded slice are used to recover or hide these errors so as to achieve the effect of antierror code. The FMO schema is shown in Figure 9.

**4.4. Server RTCP Feedback Congestion Control.** Congestion phenomenon usually occurs in the communication network environment concurrent or excessive packet number of cases; at this time, if the network cannot satisfy the application requirements, the part of the network that

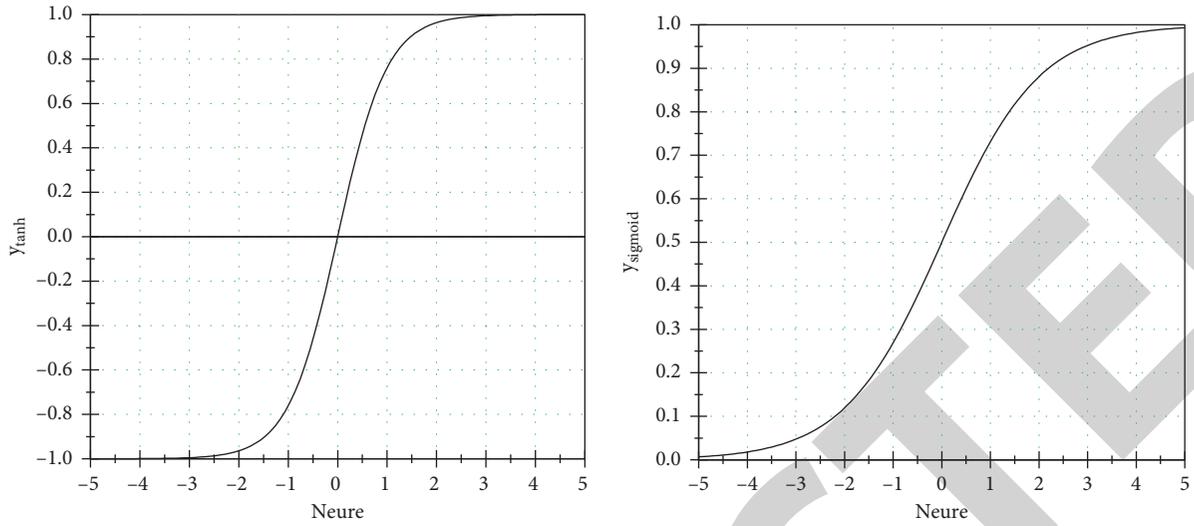


FIGURE 4: The Sigmoid and Tanh functions.

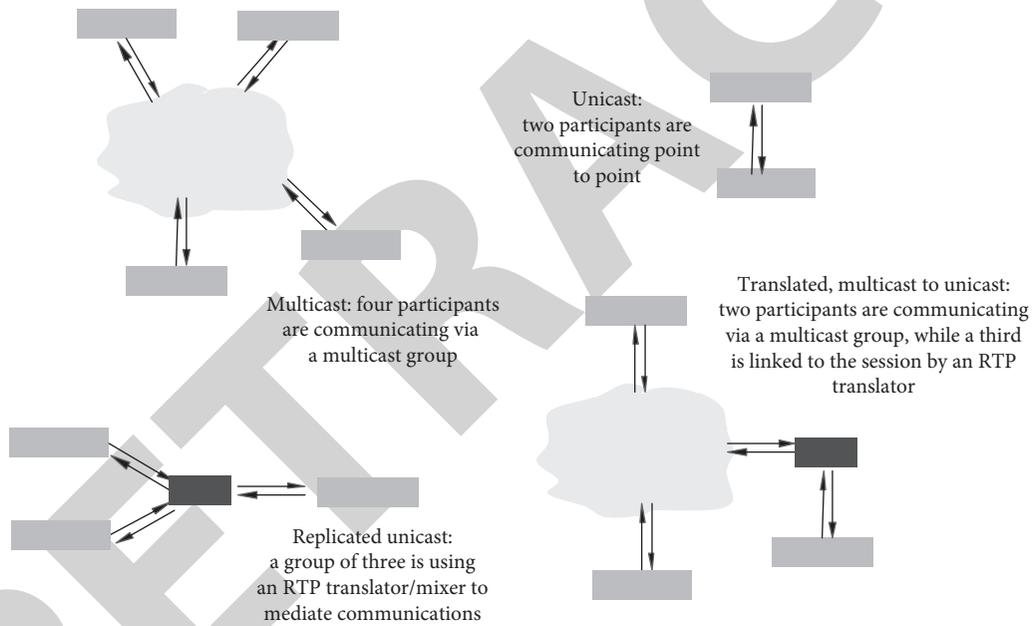


FIGURE 5: The report of RTCP.

has had no time to deal with this part will eventually cause live and even the entire network performance degradation of the network. Congestion occurs frequently in the scene to a large extent, which influences the quality of the receiver live streams and congestion control; in a kind of way, the effective reduction of the network congestion is of great significance in the actual research.

Because the system designed in this paper uses UDP for data transmission, the congestion control mechanism based on RTCP feedback designed in this paper is designed for UDP. Current congestion control mechanism on UDP mainly has two kinds: the first is the imitation type to reduce the increase in AIMD congestion control caused by TCP (their sum will increase congestion, and their product will reduce congestion). The second type is TCP-Friendly

Congestion Control (TFRC). Compared with the jitter caused by the change of speed in AIMD mechanism, the stability of TFRC mechanism makes it more suitable to be used in real-time broadcast system. The receiving end feeds back the data packet to the server periodically, and the sending end calculates the new rate according to the TCP steady-state flow formula and compares it with the current sending rate and dynamically adjusts the current sending rate according to the adjustment mechanism.

The above TFRC mechanism uses the following formula to calculate throughput (PADHYE model):

$$S = \frac{Q_{\min}^2}{t_{KTP} \sqrt{3p/b} + t_{KTO} \times \left[ \sqrt{bp} \cdot p(1 + 32p^3) \right]} \quad (1)$$

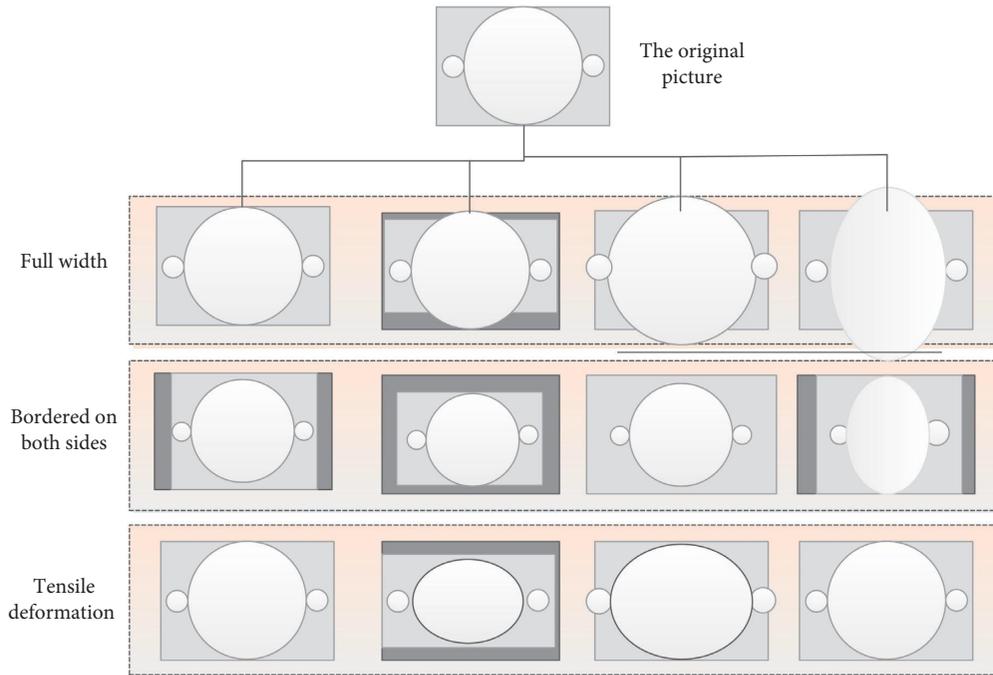


FIGURE 6: Distortion diagram of original picture.

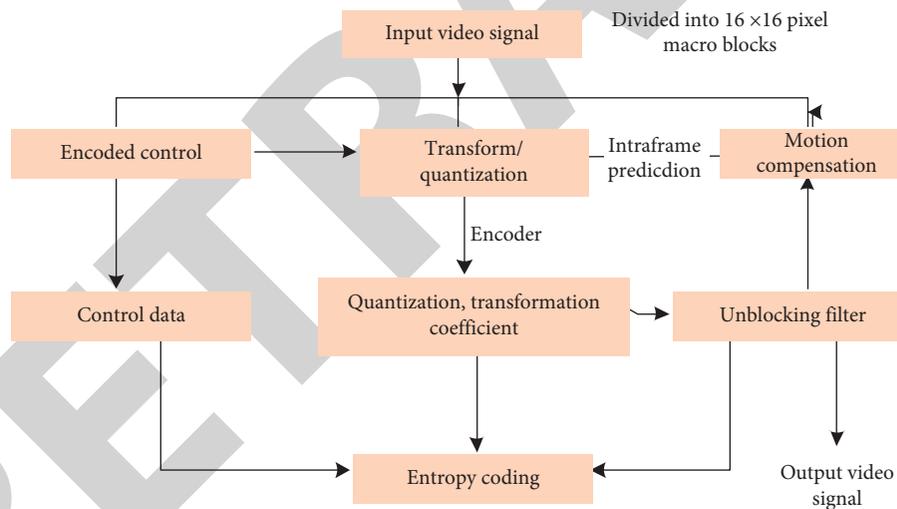


FIGURE 7: Block diagram of coding system of H.264 video coding layer.

In formula (1),  $S$  is the average throughput rate; the unit is  $B/S$ ;  $Q_{\min}$  is the size of the packet in bytes;  $TRTT$  is the link loop back time Round Trip Time (RTT), the unit is  $s$ ;  $TRTO$  is the retransmission time-out time of TCP, in  $s$ ;  $B$  is the range of packet loss event rate from 0 to 1.0. The default number of received messages acknowledged for each TCP reply is 1.

**4.5. Reduction of Deployment and Maintenance Costs.** The hardware of the video and audio acquisition terminal used in the project includes the mobile phone with the function of video and audio acquisition, and the corresponding mobile phone client is developed by the research and development

personnel in the software. Mobile phone client supports Windows Mobile, Apple Phone, Android, Symbian, and other platforms of mobile phone models; transmission code rate is up to 300 Kbps. And having the basic function of mobile phone client for all registered users who open the club's official website, this completely satisfies the masses of breaking news time video-audio acquisition equipped with 3 '3 project GBox terminal (single); the terminal can use audio wire connected to the mainstream of the camera interface, get real-time image, through a single card to use 3G wireless network to send 3G live media server. The terminal mainly uses MPEG.4 compression format; the maximum transmission rate can reach 500 Kbps, and it supports two-way calls. The project is also equipped with several other kinds of

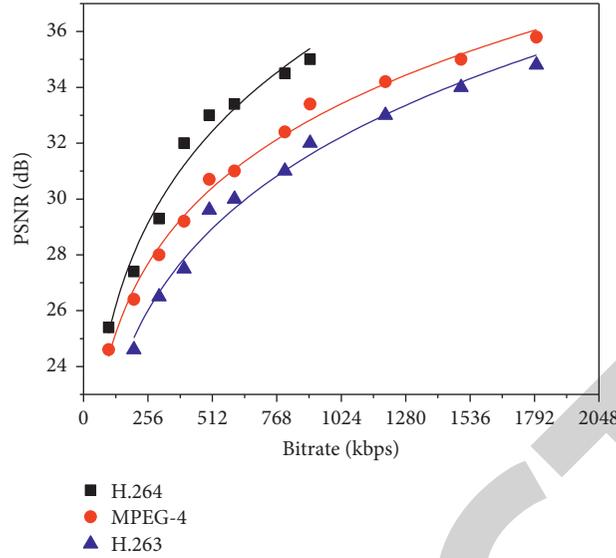


FIGURE 8: Encoder performance comparison.

hardware: 3G SuperBox dual-card terminal, 3G Box3000 multicard terminal. These terminals can be carried by an ordinary person and deployed quickly after professional training. This deployment method greatly reduces the deployment cost in the early stage and realizes the individual combat plan of news event gathering.

## 5. System Performance Test

**5.1. CPU Occupancy Test.** The measurement of real-time system performance indicators is mainly reflected in the concurrent processing scenarios in the system. For I, the CPU occupancy rate of the test results is I, respectively. In the case of a single user and 20 users with 1 usage data 9 every 5 minutes, a total of 20 time 9 is required. The final CPU occupancy rate was 1%~3% under the condition of 320 users in 6~9% CPU utilization, as shown in Figure 10. The results show that the CPU utilization rate of the system server is closely related to the number of users. When there is only one user, the CPU utilization of the system server is around 1.5%. When you have 20 users, the occupancy rate is about 7%. The CPU occupancy rate is not directly proportional to the number of users, and the increase of a certain number of users is relatively small. Thus, the system can realize effective allocation of CPU to meet the needs of multiple users online at the same time.

**5.2. Effect Test of Congestion Control Based on RTCP Feedback.** Network congestion is mainly embodied in the video delay and picture quality. Based on the peak network usage period, when there are 20 concurrent users using the feedback control scheme, the delay test method before and after each tested o is I. At the same time, the data packet is sent to record the system time T1, and it is put into the transmission of the data packet. We receive the data packet at the receiving end, extract the timestamp, and then get the current system time T2 again to get the accurate delay (T2-T1). Table 1 summarizes the results of the effectiveness test based on

RTCP feedback congestion control. According to Table 1, when the congestion control scheme in this paper is not adopted, the delay time is about 2 s, and frame skipping and Mosaic phenomenon will appear. However, the delay time is about 100 ms after adopting the congestion control scheme, and the picture is relatively clear and smooth, and there is basically no frame loss and blur phenomenon in the picture. Under the UDP way, this article proposed feedback congestion control mechanism based on RTCP to achieve the expected effect. Live streaming in real time is better to delay concurrent processing; the small 3 system has been improved, and the image quality is relatively clear and smooth, reducing network congestion and reducing packet loss, which can meet the requirements of audio and video broadcasting for real-time performance and image quality.

**5.3. Image Processing Test.** In order to find out the performance of the system image processing, the technical indexes of LUPA4000 image sensor, such as the defect pixel, the nonuniformity of optical response, and the signal-to-noise ratio, were tested.

The defect pixel detection of the image sensor was carried out under the condition of 24°C environment temperature and 20 ms integration time. The test results are shown in Table 2. The number of defect pixels is 17371, accounting for 0.41% of the total number of defect pixels, in which the majority of defect pixels respond to overbrightness in dark background.

The standard root mean square deviation method was used to test the nonuniformity of optical response. According to formula (2), the nonuniformity of optical response PRNU of the CMOS image sensor was calculated.

$$\text{PRNU} = \frac{1}{V_O^2} \sqrt{\frac{\sum_{i=1}^n (\overline{V_{O_i}} - \overline{V_o})^2}{n+1}} \times 100\%, \quad (2)$$

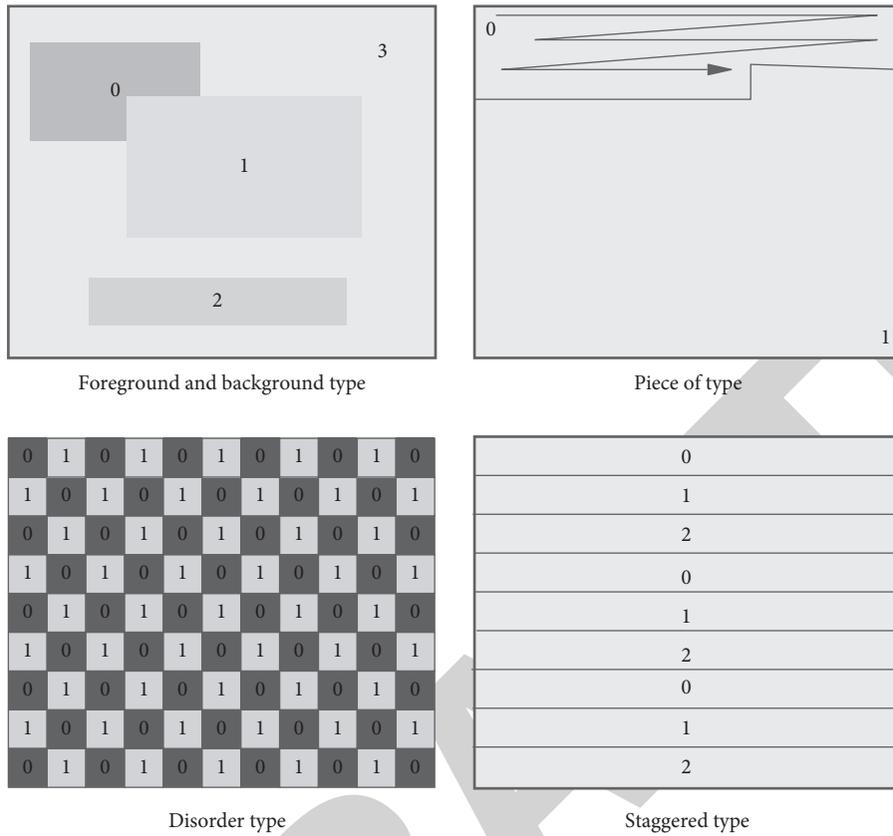


FIGURE 9: FMO mode.

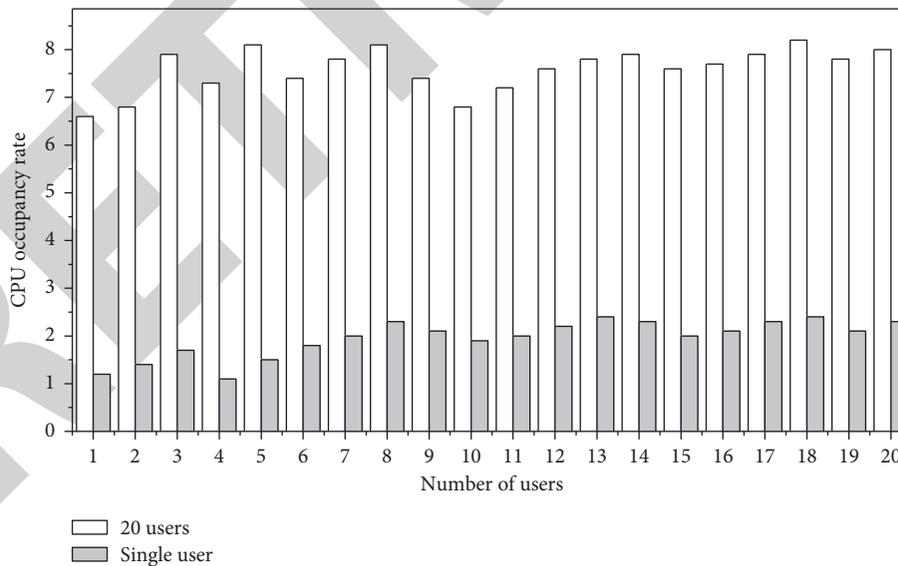


FIGURE 10: CPU usage of the system server.

where  $V_o$  is the average output signal of the device;  $n$  is the number of photosensitive surface pixels; and  $V_{O_i}$  is the output signal of the pixel. According to the above method, when the ambient temperature is 24°C and the device is in the state of half-saturation, the nonuniformity of light response of the LUPA4000 image sensor tested is 2.09%.

Change the exposure of the image sensor and test the SNR under different exposures. Set the output signal of LUPA4000 when it is saturated as  $V_{sat}$ , and test the SNR of LUPA4000 image sensor when its output signal value is 10%  $V_{sat}$ , 30%  $V_{sat}$ , 50%  $V_{sat}$ , 70%  $V_{sat}$ , 90%  $V_{sat}$ , etc. The test results are shown in Figure 11.

TABLE 1: Results of an effect test based on RTCP feedback congestion control.

	Delay	Image	
Before processing	Around 2.5s	Frame hopping and Mosaic will appear on the screen	
After processing	Around 80 ms	The picture is clear and smooth, and there will be no loss of frames and blurred picture	

TABLE 2: Defective pixels test results.

Defective pixels in dark background	17367
Bright defective pixels in half-saturation	438
Dark defective pixels in half-saturation	0
Total defective pixels	17371

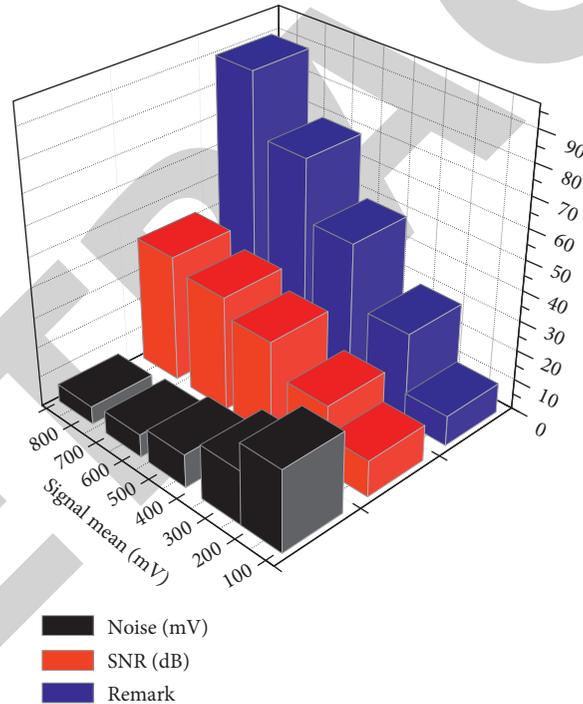


FIGURE 11: SNR test results.

For images with different integration time (image signal mean covering 10% $V_{sat}$ ~90% $V_{sat}$ ) under uniform illumination, dark background deduction, defect pixel replacement, nonuniform correction, and different processing combinations were studied, respectively. The SNR improvement under different processing methods was shown in Figure 4. Based on the above analysis, the combined use of the three methods and the processing method of nonuniform correction + defect pixel replacement can achieve the best processing effect. Due to the dark background subtraction in the different integral time and

temperature changes, the need for collecting background will greatly increase the workload, and actual application is not easy to operate, so taking the engineering practice into consideration, including a combination of background subtraction method is not recommended; neuron to replace the defects of nonuniform correction + method is the best choice. Under uniform illumination, nonuniform correction + defect pixel replacement is used.

The imaging images were processed by the method, and the comparison of imaging effects before and after processing is shown in Figure 12. As can be seen from Figure 13,

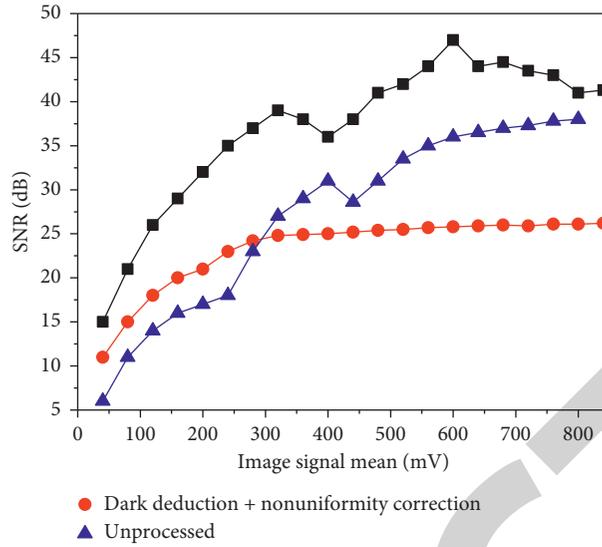


FIGURE 12: Comparison of imaging effects before and after processing.

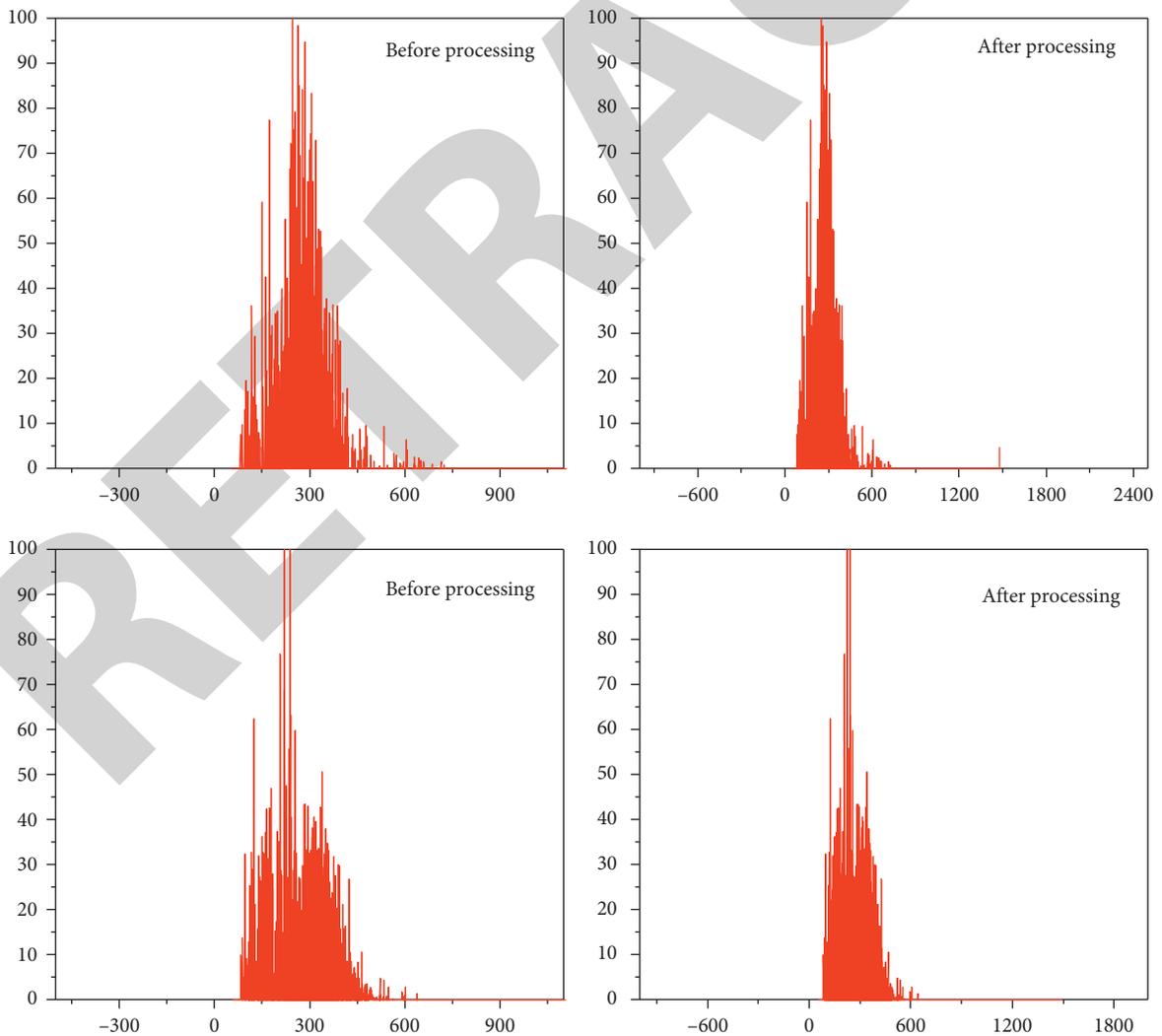


FIGURE 13: Comparison diagram of the effect of flight uniformity correction + defect pixel replacement.

through image processing, the white point noise and fringe noise in the original image are eliminated, the image is smooth and uniform, and the gray value distribution of the image is more concentrated.

## 6. Conclusion

With the continuous development of technology, high-definition TV programs have become an indispensable part of people's lives. Compared with the traditional streaming media service, this paper builds 5G Live news broadcast system based on the integration of international advanced dynamic intelligent coding technology, more binding technology, stable and reliable implementation of 4 K high-definition broadcast live video images, has low cost, high flexibility, easy operability, easy networking, high anti-interference, and high stability, can be realized at any time and any place news broadcast. At the same time, the system does not need any expensive transmission vehicles, satellite links, professional on-site technical personnel support, only need on-site reporters and camera personnel to complete the remote broadcast effect, so the program production cost of the TV station is greatly reduced, and the cost of personnel input is reduced. At the same time, 5G transmission has emerged, 5G backpack is under development, 4 K + 5G live broadcasting has been realized, and 5G network VR program production and broadcasting business scenarios are gradually realized. Further organic integration of 4K, 5G, AI, and other technologies with radio and television business will realize the innovation of the whole radio and television business. It is hoped that the research design of this paper can provide a reference for the next UHD live broadcast of TV stations.

## Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

## Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

## References

- [1] Z. Jianzhong and G. Radio, "Design and implementation of smartphone broadcast system based on wireless," *Radio & TV Broadcast Engineering*, vol. 13, no. 23, pp. 02–05, 2018.
- [2] F. A. N. Qing, H. LI, D. HU et al., "Research on the application of mobile communication technology in TV broadcast," *DEStech Transactions on Computer Science and Engineering*, vol. 34, no. 1, pp. 24–31, 2018.
- [3] C. L. Higgins-Dobney and G. Sussman, "The growth of TV news, the demise of the journalism profession," *Media, Culture & Society*, vol. 35, no. 7, pp. 847–863, 2013.
- [4] Y. Qin, "Transmission reliability of wireless communication system-based on optical fiber signal processing," *Journal of Optical Communications*, vol. 5, no. 1, pp. 1–5, 2019.
- [5] C. Tanougast, W. W. Mohamad-Al-Fadl Rihani, M. H. Seyedi et al., "Recent advances in wireless communication," *Recent Advances in Wireless Communication*, vol. 2, no. 13, p. 189, 2019.
- [6] G. Y. Jeong, "A study on the stabilization of bit rate and LTE for the TV broadcasting," *International Journal of Advanced Culture Technology*, vol. 6, no. 4, pp. 266–274, 2018.
- [7] C. P. Lau, A. Alabbasi, and B. Shihada, "An efficient live TV scheduling system for 4G LTE broadcast," *IEEE Systems Journal*, vol. 11, no. 4, pp. 2737–2748, 2016.
- [8] G. K. Walker, J. Wang, C. Lo, X. Zhang, and G. Bao, "Relationship between LTE broadcast/eMBMS and next generation broadcast television," *IEEE Transactions on Broadcasting*, vol. 60, no. 2, pp. 185–192, 2014.
- [9] Z. Jingwen and N. Radio, "Application of 3G/4G technology in ningxia television station," *Video Engineering*, vol. 20, no. 16, p. 14, 2015.
- [10] L. Dai, Z. Wang, and Z. Yang, "Next-generation digital television terrestrial broadcasting systems: key technologies and research trends," *IEEE Communications Magazine*, vol. 50, no. 6, pp. 150–158, 2012.
- [11] O. Issa, W. Li, and H. Liu, "Performance evaluation of TV over broadband wireless access networks," *IEEE Transactions on Broadcasting*, vol. 56, no. 2, pp. 201–210, 2016.
- [12] M. Shafi, A. F. Molisch, P. J. Smith et al., "5G: a tutorial overview of standards, trials, challenges, deployment, and practice," *IEEE Journal on Selected Areas in Communications*, vol. 35, no. 6, pp. 1201–1221, 2017.
- [13] L. Zhang, A. Thalhammer, A. Rettinger, M. Färber, A. Mogadala, and R. Denaux, "The xLiMe system: cross-lingual and cross-modal semantic annotation, search and recommendation over live-TV, news and social media streams," *Journal of Web Semantics*, vol. 47, no. 1, pp. 20–30, 2017.
- [14] S. E. Gollust, E. F. Fowler, and J. Niederdeppe, "Television news coverage of public health issues and implications for public health policy and practice," *Annual Review of Public Health*, vol. 40, no. 1, pp. 167–185, 2019.
- [15] Z. Jianzhong, "Design and implementation of smartphone broadcast system based on wireless network technology," *Radio & TV Broadcast Engineering*, vol. 15, no. 1, p. 02, 2017.
- [16] G. Y. Jeong, "A study on the stabilization of bit rate and LTE for the TV DMNG broadcasting," *Journal of Advanced Culture Technology*, vol. 6, no. 4, pp. 266–274, 2020.
- [17] F. Guribye and L. Nyre, "The changing ecology of tools for live news reporting," *Journalism Practice*, vol. 11, no. 10, pp. 1216–1230, 2017.
- [18] P. Arce, I. de Fez, R. Belda, J. C. Guerri, and S. Ferrairó, "Proxy-based near real-time TV content transmission in mobility over 4G with MPEG-DASH transcoding on the cloud," *Multimedia Tools and Applications*, vol. 78, no. 18, pp. 26399–26425, 2019.
- [19] M. Martišius, "Television goes mobile: the transformation of the audio-visual media market," *Informacijos Mokslai*, vol. 84, pp. 62–80, 2018.
- [20] S. Jamil, G. Appiah-Adjei, and G. Appiah-Adjei, "Journalism in the era of mobile technology: the changing pattern of news production and the thriving culture of fake news in Pakistan and Ghana," *Journal of Russian Media and Journalism Studies*, vol. 1, no. 3, pp. 42–64, 2019.
- [21] J. Zhao, J. Liu, J. Jiang et al., "Efficient deployment with geometric analysis for mmWave UAV communications," *IEEE Wireless Communications Letters*, vol. 9, no. 7, pp. 1115–1119, 2020.

- [22] Y. Zhou, L. Tian, C. Zhu et al., "Video coding optimization for virtual reality 360-degree source," *IEEE Journal of Selected Topics in Signal Processing*, vol. 14, no. 1, pp. 118–129, 2019.
- [23] A. Li, D. Spano, J. Krivochiza et al., "A tutorial on interference exploitation via symbol-level precoding: overview, state-of-the-art and future directions," *IEEE Communications Surveys & Tutorials*, vol. 22, no. 2, pp. 796–839, 2020.
- [24] B. Cao, X. Wang, W. Zhang, H. Song, and Z. Lv, "A many-objective optimization model of industrial internet of things based on private blockchain," *IEEE Network*, vol. 34, no. 5, pp. 78–83, 2020.
- [25] J. Yang, M. Xi, B. Jiang et al., "FADN: fully connected attitude detection network based on industrial video," *IEEE Transactions on Industrial Informatics*, vol. 17, no. 3, pp. 2011–2020, 2020.

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